(NASA-CR-170194) TECHNOLOGY RESEARCH FOR DIGITAL FLIGHT CONTROL Status Report, 1 Oct. 1982 - 31 Mar. 1983 (University of Southern Colorado, Pueblo.) 12 p HC A02/MF A01 CSCL 01D G3/06

N83-22197

Unclas 03401

School of Applied Science and Engineering Technology

UNIVERSITY OF SOUTHERN COLORADO
2200 North Bonforte Boulevard
Pueblo, Colorado 81001

ORIGINAL PAGE IS
OF POOR QUALITY

UNIVERSITY OF SOUTHERN COLORADO

2200 North Bonforte Boulevard
SCHOOL OF APPLIED SCIENCE AND ENGINEERING TECHNOLOGY
Pueblo, Colorado 81001

Status Report

on

NASA Cooperative Agreement # NCC 2-041

Technology Research for Digital Flight

Control and Guidance

October 1, 1982 - March 31, 1983

by

University of Southern Colorado

Pueblo, Colorado

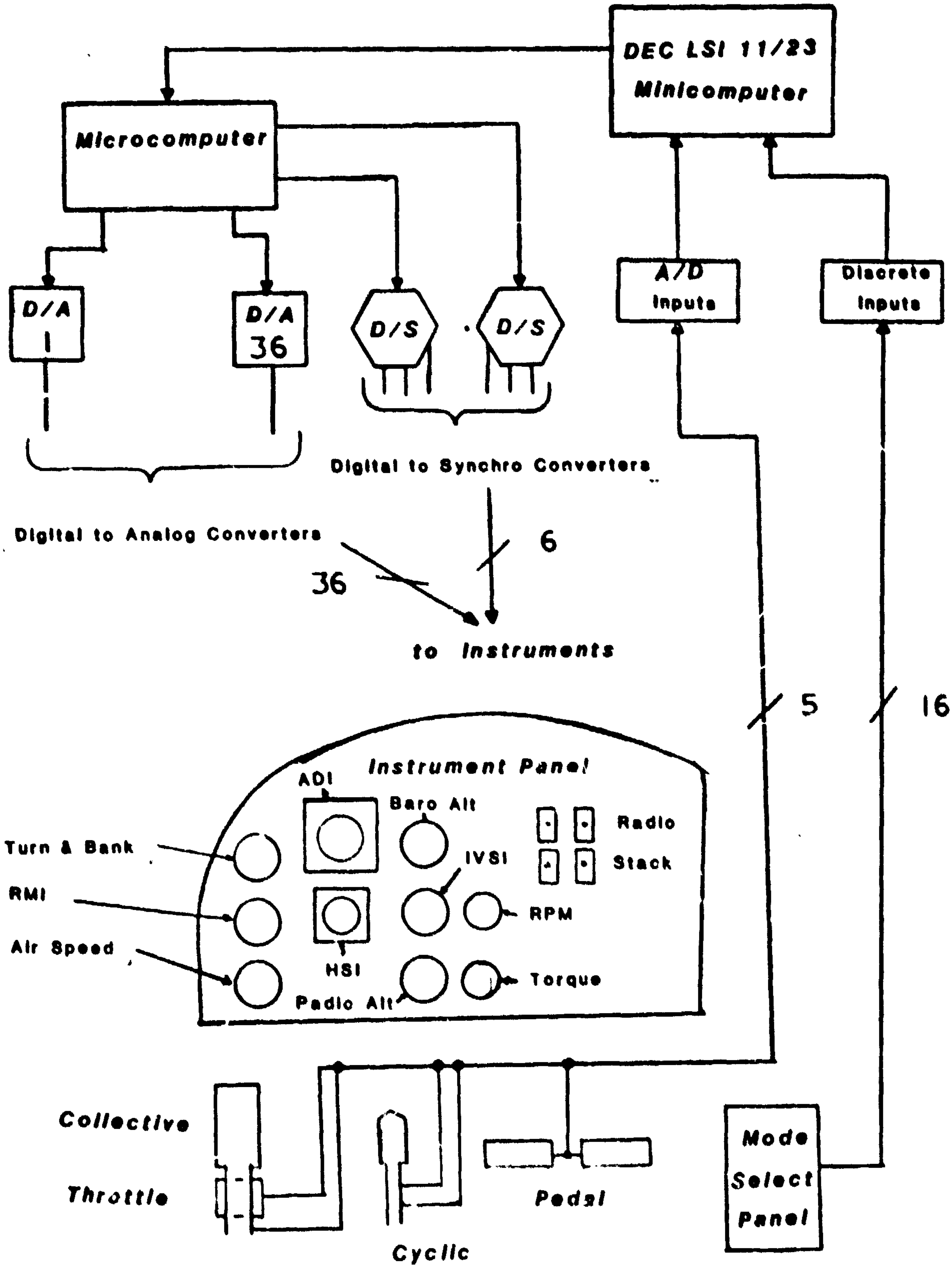
Principal Investigator - R. A. Carestia

ORIGINAL PAGE IS
OF POOR QUALITY

The University of Southern Colorado Research Engineers are involved in research investigating the use of advanced avionics systems technologies. Specifically, the objective of the research is to investigate the use of advanced digital systems for flight control and guidance for a specified missions. The research areas include advanced electronic system architectures, tests with the Global positioning system (GPS) in a helicopter, and advanced integrated systems concepts for rotorcraft. In these research areas, the research staff is concentrating its effort on: Investigating the use of advanced digital systems for flight control in a search and rescue mission; An investigation of differential Global positioning systems to provide a data base of performance information for navigation; And a study to determine the present usage and trends of microcomputers and microcomputer components in the avionics industries.

The accomplishments of the first area, the investigation of advanced digital systems for flight control, has led to the development of a special purpose simulator to be used to evaluate the effectiveness of advanced system concepts in rotorcraft. In order to produce an accurate evaluation criteria for assessing this effectiveness, a base line simulator was developed to study pilot system interaction. The research staff provided the system design and many of the special purpose interfaces were designed and built by students at the University of Southern Colorado. Figure 1 shows a block diagram of the RODAAS simulator.

Figure 1 RODAAS Simulator



The present instrument panel is typical of that in a UH-1H helicopter and will be used to obtain baseline information which will be used for comparison with advanced systems. The mathematical model for a helicopter along with a flight scenario will be implemented in the Dec LSI 11/23 minicomputer. All instrument controls are being implemented in a microcomputer. In the following months an experiment plan will be developed and tests will be conducted to determine evaluation criteria for assessing the effectiveness of the pilot-system interaction. The critical elements will be identified and studied to determine where advanced research concepts are most applicable.

The initial effort on the task in the second area of research (Global Positioning System) was to develop a bibliography of the recent GPS related work. Pertinent articles were collected and evaluated to identify for NASA all applicable previous research to insure that the research to be performed by the University of Southern Colorado research staff would not be duplicative. The next six months will be spent integrating and testing the GPS Z-set, the interface processor, and the PDP 11/34 system. Software will be written for the NASA computer to extract required information from the Z-set thru the Interface processor.

ORIGINAL PAGE IS
OF POOR QUALITY

For the third task, a questionnaire was developed and sent out to avionics companies to determine the trends for use of microcomputers and microcomputer components in the avionics industry. Enclosed is a copy of the final questionnaire that was distributed. Results obtained from the response of the avionics industry to this questionnaire are now being evaluated and a statistical analysis will be performed to determine the trends of microcomputers in advanced avionics systems.

ORIGINAL PAGE IS
OF POOR QUALITY

(1) What was the first microprocessor that you used? ____________

(2) What year did you first use microprocessors? ____________

(3) In 1982, have you purchased or do you plan to purchase MPU systems?

____YES ____NO

A. If yes, will they be:

____Standard ____Dedicated ____Custom

B. Have they been or will they be:

____4 bit ____8 bit ____12 bit ____16 bit ____Over 16 bit

____All of these

C. Will they be:

____IIL ____Schottky ____CMOS ____NMOS ____PMOS

____All of these

(4) How will you procure your MPUs? (check all that apply)

____As chips alone for in-house design (Components)
____As chips on boards (Sub-System)
____As assembled modules
____Complete MPU system (includes memories and power supplies)

If assembled modules, which ones do you contemplate buying?

____Processor-on-a-board ____Memory module, size ____________
____I/O module ____D/A or A/D converter modules
____Other ____________

(5) Does your MPU application relate to: (check all that apply)

____Digital system (discretes)
____Electromechanical system
____Microcomputer control system
____Avionics computer system
____Functional display system

(6) In what applications do you use your microcomputer systems? (check all that apply)

____Ground Support Equipment ____Navigation
____Flight Management Systems ____Guidance
____Flight Test Systems ____Control Systems
____Data Acquisition Systems ____Instrumentation
____Communications Systems ____Weapon Control Systems
____Other: ____________

ORIGINAL PAGE IS
OF POOR QUALITY

(7) Which of the following factors do you feel are the most important in your company's MPU buying decisions?

_____Price
_____Performance
_____Second src.
_____Distributor credibility
_____Users group/Software library
_____Device warranty
_____Reliability
_____Documentation
_____Training avail.
_____Applications support
_____Development systems
_____Devel. software avail.
_____Applic. software avail.
_____Speed
_____Number of family support devices avail.

(8) Is the microprocessor architecture a: (check all that apply)

_____General purpose microprocessor
_____All-in-one microprocessor
_____Bit slice microprocessor
_____VHSIC microprocessor (Very High Speed IC)

(9) Did the microprocessor perform as expected?

_____Yes _____No

(10) If not, tell why?

_____Not fast enough
_____Limited I/O ports
_____Limited interrupt capability
_____Limited memory addressing capability
_____Other ______________________________

(11) Will you be using advanced architectures such as bit-slice, Z8000, 68000, etc. in the future?

_____Yes _____No

If yes, what general application, and why?

Application ______________________________,

_____Speed
_____Memory capability
_____Bit size
_____Cost
_____Other ____________________
_____Power ratings
_____Performance
_____Reliability
_____I/O

If no, why not?

_____Speed
_____Memory capability
_____Bit size
_____Cost
_____Other ____________________
_____Power ratings
_____Performance
_____Reliability
_____I/O

(12) Have you used or do you plan to use semiconductor memories and/or bubble memories during 1982 or 1983?

___ Semiconductor ___ Bubble ___ Neither

(13) What speed (maximum access time in ns) is best suited for your system? (check all that apply)

Dynamic RAMs (MOS	___ 80	___ 120	___ 200	___ 250	___ 300	___ Other ___		
Dynamic RAMs (Bipolar)	___ 80	___ 120	___ 200	___ 250	___ 300	___ Other ___		
Static RAMs (MOS)	___ 20	___ 35	___ 45	___ 55	___ 70	___ 120	___ 150	
Static RAMs (CMOS)	___ 200	___ 250	___ 300	___ 450	___ Other ___			
Static RAMs (Bipolar)	___ 200	___ 250	___ 300	___ 450	___ Other ___			
ROMs (MOS)	___ 100	___ 150	___ 200	___ 250	___ 350	___ 450	___ Other ___	
ROMs (Bipolar)	___ 100	___ 150	___ 200	___ 250	___ 350	___ 450	___ Other ___	
PROMs (MOS)	___ 25	___ 80	___ 100	___ 120	___ 150	___ 200	___ Other ___	
PROMs (Bipolar)	___ 25	___ 80	___ 100	___ 120	___ 150	___ 200	___ Other ___	
EPROMs (MOS)	___ 150	___ 200	___ 250	___ 350	___ 450	___ Other ___		
EEPROMs (MOS)	___ 150	___ 200	___ 250	___ 350	___ 450	___ Other ___		
PSEUDO-Statics (MOS)	___ 200	___ 250	___ 300	___ 450	___ Other ___			
Bubble (Solid-State)	___ 5000	___ 10000	___ 20000	___ 40000	___ Other ___			

(14) How much total memory will your system require in 1982 and 1983? (bytes)

1982	1K or Less	2K	4K	8K	16K	32K	64K	128K	256K	>
Dynamic RAMs (MOS)										
Dynamic RAMs (Bipolar)										
Static RAMs (MOS)										
Static RAMs (CMOS)										
Static RAMs (Bipolar)										
ROMs (MOS)										
ROMs (Bipolar)										
PROMs (Bipolar)										
PROMs (MOS)										
EPROMs (MOS)										
EEPROMs (MOS)										
PSEUDO-Statics (MOS)										
Bubble (Solid-State)										

1983	1K or Less	2K	4K	8K	16K	32K	64K	128K	256K	>
Dynamic RAMs (MOS)										
Dynamic RAMs (Bipolar)										
Static RAMs (MOS)										
Static RAMs (CMOS)										
Static RAMs (Bipolar)										
ROMs (MOS)										
ROMs (Bipolar)										
PROMs (Bipolar)										
EPROMs (MOS)										
EEPROMs (MOS)										
PSEUDO-Statics (MOS)										
Bubble (Solid-State)										

ORIGINAL PAGE IS
OF POOR QUALITY

(15) Which of the following factors do you feel are important in your memory buying decisions? (Check all that apply)

____Speed
____Parts availability
____Ease of use
____Board density
____Price
____Reliability documentation
____State-of-the-art
____Second source
____Application support
____Warranty
____Manufacturers credibility
____Performance
____Broad line support
____Technical support
____Access cycle
____Active power
____Standby power
____Reputation
____Application information
____Delivery
____Power
____Soft failure

(16) In your system, how important is EPROM to mask ROM compatibility?

____Will not use EPROM without pin compatible mask ROM
____Compatibility not important

(17) Does the system incorporate any external data storage?

____Floppy disk ____Cassette ____Paper tape ____EEPROM

____Magnetic tape ____Hard disk ____Bubble memory

(18) How many I/O ports does the microprocessor support? ____________

(19) Does your MPU-based system replace a current non-MPU based system?

____Yes ____No

If yes, how many discrete ICs or other semiconductor elements have been eliminated?

____0-10 ____10-20 ____20-100 ____100-200 ____Over 100

(20) What discrete devices or ICs are critical or key to your MPU systems?

____Linear ICs
____DA/ADs
____FETs
____Other: ____________________

(21) Will you use the system development tools that are marketed by microprocessor manufacturers?

____Yes ____No

What specific system development tools do you/will you use? (check all that apply)

____MPU development system
____Computational mainframe
____Logic analyzer
____Circuit emulation
____Time sharing
____Systems evaluation tool
____Others: ____________________

ORIGINAL PAGE IS
OF POOR QUALITY

(22) How important is availability of high-level languages?

_____Very _____Somewhat _____Not important

If a high-level language is important, which do you favor?

_____Basic _____Fortran _____Other: _______________
_____PL/M _____Pascal
_____Cobol _____Ada

(23) What is the throughput and the maximum power of your microcomputer systems? (please specify the general application of the system)

Application 1 _______________

KIPS (thousands of instructions per sec)

_____100-500 _____500-1000 _____1000-1500 _____1500-2000 _____>2000

Watts

_____<1 _____1-10 _____10-20 _____20-30 _____30-40 _____>40

Application 2 _______________

KIPS (thousands of instructions per sec)

_____100-500 _____500-1000 _____1000-1500 _____1500-2000 _____>2000

Watts

_____<1 _____1-10 _____10-20 _____20-30 _____30-40 _____>40

Application 3 _______________

KIPS (thousands of instructions per sec)

_____100-500 _____500-1000 _____1000-1500 _____1500-2000 _____>2000

Watts

_____<1 _____1-10 _____10-20 _____20-30 _____30-40 _____>40

(24) Does the microcomputer system have Built-in-Test fault?

_____Yes _____No

(25) Do you use redundancy in the microcomputer systems you are designing?

_____Yes _____No

(26) If yes, what types of redundancy do you use? (please specify the general application of the system)

Application 1 _______________

(26) Continued

____Parallel ____Series ____Series-parallel
____Standby ____Partial ____Voting
____Other ________________

Application 2 ________________________________

____Parallel ____Series ____Series-parallel
____Standby ____Partial ____Voting
____Other ________________

Application 3 ________________________________

____Parallel ____Series ____Series-parallel
____Standby ____Partial ____Voting
____Other ________________

(27) Are the microcomputers used in flight systems where failures are time critical?

____Yes ____No

(28) In multiple microcomputer systems are the microcomputers operated synchronously or asynchronously in your redundant application?

____Sync ____Async

(29) What signal level threshold is used for failure detection?

____<2% ____<5% ____<10% ____>10%

Thank you!